THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. A re-bar (reinforcing rod) for concrete comprising an inner rod of a first material, and an over-wrap of a second material, said over-wrap being structurally or functionally discontinuous relative to said inner rod.
2. A reinforcing rod as claimed in claim 1, wherein said inner rod comprises a rod made from a material consisting of a polymeric material or a polymeric matrix and reinforcing fibre.
3. A reinforcing rod as claimed in claim 1 or 2, wherein said over-wrap is a polymeric material or a fibrous material set in a polymeric matrix.
4. A reinforcing rod as claimed in claim 3, wherein said fibrous material is selected from the group consisting of ceramic materials including carbon and glass fibres, polymeric materials such as aramid and polyethylene, and metallic materials like steel.
5. A reinforcing rod as claimed in claim 4, wherein said resin is selected from the group consisting of thermoset resins such as epoxies, polyesters, and vinyl esters, and thermoplastic resins such as nylon, polyethylene, and polypropylene.
6. A reinforcing rod as claimed in claim 3, 4 or 5, wherein said over-wrap includes zones of weakness separating full strength lengths of said outer layers.
7. A reinforcing rod as claimed in claim 3, 4 or 5, wherein said over-wrap includes zones of low frictional shear stress between the over-wrap and the inner rod interspersed among high frictional shear stress zones.
8. A reinforcing rod as claimed in claim 7 wherein said low frictional shear stress zones are achieved by application of a layer of low friction material on said inner rod at said zones of low frictional shear stress, and said over-wrap covers said low frictional material.
9. A reinforcing rod as claimed in claim 6 wherein said zones of weakness are formed by mechanically removing a portion of said over-wrap after it has been applied to said inner rod.
10. A reinforcing rod as claimed in claim 6, wherein said zones of weakness are defined by short spaced apart lengths of said inner rod having no outer-wrap over same.
11. A reinforcing rod as claimed in claim 6 wherein said zones of weakness are defined by local shearing of polymer over-wrap.
12. A reinforcing rod as claimed in any one of claims 1 to 10, wherein said inner rod is a cylindrical rod having radius r_r and an ultimate tensile strength σ_{ur}, the frictional shear stress

after bond failure between the inner rod and the over-wrap is τ_r, and said over-wrap is comprised of structurally discontinuous portions having a maximum length L_{co}, wherein

$$L_{co} = \frac{\sigma_{ur} r_r}{\tau_r}$$

13. A rod as claimed in claim 12, wherein said radius *r* is in the range of 1-30mm.
14. A rod as claimed in claim 12, wherein said length L_{co} is in the range of 1-150 cm.
15. A rod as claimed in claim 13 or 14, wherein said radius *r* is in the range of 3-8 mm.
16. A rod as claimed in claim 15, wherein said radius *r* is in the range of 4-6 mm.
17. A rod as claimed in claim 16, wherein said radius *r* is in the range of 4-5 mm.
18. A rod as claimed in claim 17, wherein said radius *r* is 4.5 mm.
19. A rod as claimed in any one of claims 13 to 18, wherein said length *L* is in the range of 10-20 cm.
20. A rod as claimed in claim 19, wherein said length *L* is in the range of 12-18 cm.
21. A rod as claimed in 20, wherein said length *L* is about 15 cm.
22. A method of inducing pseudo-ductility or toughness in a fibre reinforced composite rod, said rod comprising a solid core and a fibre reinforced polymeric resin over-wrap on said core, said method comprising structurally interrupting said over-wrap at spaced apart locations.
23. A method as claimed in claim 22, wherein said over-wrap is applied as a resin impregnated fibre braid.
24. A method as claimed in claim 22 or 23, wherein said over-wrap is applied as a resin impregnated fibre yarn, unidirectional tape or woven fabric tape helically wound on said core.
25. A method as claimed in claim 22 to 24, wherein said over-wrap is structurally interrupted by being cut in spaced apart annular rings.
26. A method as claimed in claim 22 to 24, wherein said over-wrap is structurally interrupted by being cut in a continuous helical pattern.
27. A method as claimed in claim 22, comprising the steps of
    i) providing an inner rod comprising solid core a fibre reinforced polymer
    ii) applying bands of material having low frictional shear stress at spaced apart locations on said solid core
    iii) applying a fibre reinforced polymeric resin over-wrap over the banded core,

whereby said bands of low frictional shear stress material structurally separate zones of over-wrap bonded to said core.

28. A method as claimed in any one of claims 22 to 27, wherein said solid core is a cylindrical rod having radius r_r and an ultimate tensile strength σ_{ur}, the frictional shear stress after bond failure between the solid core and the over-wrap is τ_r, and said over-wrap is comprised of structurally discontinuous portions having a maximum length L_{co}, wherein

$$L_{co} = \frac{\sigma_{ur} r_r}{\tau_r}$$

29. A method as claimed in claim 28, wherein said radius r is in the range of 1-30mm.

30. A method as claimed in claim 28, wherein said length L_{co} is in the range of 1-150 cm.

31. A method as claimed in claim 29 or 30, wherein said radius r is in the range of 3-8 mm.

32. A method as claimed in claim 31, wherein said radius r is in the range of 4-6 mm.

33. A method as claimed in claim 32, wherein said radius r is in the range of 4-5 mm.

34. A method as claimed in claim 33, wherein said radius r is 4.5 mm.

35. A method as claimed in any one of claims 29 to 34, wherein said length L is in the range of 10-20 cm.

36. A method as claimed in claim 35, wherein said length L is in the range of 12-18 cm.

37. A method as claimed in 36, wherein said length L is about 15 cm.

38. A reinforcing rod comprising a composite of at least two materials, at least one of which is present in structurally discontinuous lengths.

39. A reinforcing rod as claimed in claim 38, comprising at least three materials, at least one of which is present in structurally or functionally discontinuous lengths.

40. A reinforcing rod as claimed in claim 38, wherein said composite comprises a polymer matrix having embedded therein structurally discrete meso-rods of length L_{c_m} with radius r_m, ultimate and tensile strength σ_{um}, the frictional shear stress between a meso-rod and the polymer matrix being represented by τ_m, wherein

$$L_{c_m} \leq \frac{\sigma_{um} r_m}{\tau_m}$$

41. A reinforcing rod as claimed in claim 40, wherein said structurally discrete meso-rods comprise a plurality of aligned meso-rods that are, axially, substantially randomly distributed.

42. A reinforcing rod as claimed in claim 40, wherein said structurally discrete meso-rods comprise a plurality of elongated meso-rods breakable by a tensile load substantially less than the

ultimate tensile load of each meso-rod, at predetermined weakened locations that are randomly staggered, from rod to rod.

43. A reinforcing rod as claimed in claim 40, 41 or 42, wherein L_{c_m} is in the range of 5-30 cm.

44. A reinforcing rod as claimed in claim 43, wherein L_{c_m} is in the range of 5-25 cm.

45. A reinforcing rod as claimed in claim 43, wherein L_{c_m} is in the range of 8-20 cm.

46. A reinforcing rod as claimed in claim 43, wherein L_{c_m} is in the range of 10-15 cm.

47. A reinforcing rod as claimed in claim 43, wherein L_{c_m} is in the range of 11-13 cm.

48. A reinforcing rod as claimed in claim 43, wherein L_{c_m} is optimally about 12 cm.

49. A reinforcing rod as claimed in any one of claims 43 to 49, wherein r_m is in the range of 0.5-4.0 mm.

50. A reinforcing rod as claimed in any one of claims 43 to 49, wherein r_m is in the range of 0.5-3.0 mm.

51. A reinforcing rod as claimed in any one of claims 43 to 49, wherein r_m is in the range of 1.0-3.0 mm.

52. A reinforcing rod as claimed in any one of claims 43 to 49, wherein r_m is in the range of 1.5-2.5 mm.

53. A reinforcing rod as claimed in any one of claims 43 to 49, wherein r_m is about 2.0 mm.

54. A reinforcing rod as claimed in any one of claims 40 to 53, wherein said meso-rods are made from a material selected from the group consisting of ceramic materials including carbon fibres and glass fibres.

55. A reinforcing rod as claimed in claim 54, wherein said polymer matrix is selected from the group consisting of thermoset resins including epoxies, polyesters, and vinyl esters, and thermoplastic resins including nylons, polyethylene, and polypropylene.

56. A structural rod comprising a composite of at least two materials, at least one of which is present in structurally discontinuous lengths.

57. A structural rod as claimed in claim 56, comprising at least three materials, at least one of which is present in structurally or functionally discontinuous lengths.

58. A structural rod as claimed in claim 56, wherein said composite comprises a polymer matrix having embedded therein structurally discrete meso-rods of length L_{c_m} with radius r_m, ultimate and tensile strength σ_{um}, the frictional shear stress between a meso-rod and the polymer matrix being represented by τ_m, wherein

$$L_{c_m} \leq \frac{\sigma_{um} r_m}{\tau_m}$$

59. A structural rod as claimed in claim 58, wherein said structurally discrete meso-rods comprise a plurality of aligned meso-rods that are, axially, substantially randomly distributed.

60. A structural rod as claimed in claim 58, wherein said structurally discrete meso-rods comprise a plurality of elongated meso-rods breakable by a tensile load substantially less than the ultimate tensile load of each meso-rod, at predetermined weakened locations that are randomly staggered, from rod to rod.

61. A structural rod as claimed in claim 58, 59 or 60, wherein L_{c_m} is in the range of 5-30 cm.

62. A structural rod as claimed in claim 61, wherein L_{c_m} is in the range of 5-25 cm.

63. A structural rod as claimed in claim 61, wherein L_{c_m} is in the range of 8-20 cm.

64. A structural rod as claimed in claim 61, wherein L_{c_m} is in the range of 10-15 cm.

65. A structural rod as claimed in claim 61, wherein L_{c_m} is in the range of 11-13 cm.

66. A structural rod as claimed in claim 61, wherein L_{c_m} is in the range of 12 cm.

67. A structural rod as claimed in any one of claims 61 to 66, wherein r_m is in the range of 0.5-4.0 mm.

68. A structural rod as claimed in any one of claims 61 to 66, wherein r_m is in the range of 0.5-3.0 mm.

69. A structural rod as claimed in any one of claims 61 to 66, wherein r_m is in the range of 1.0-3.0 mm.

70. A structural rod as claimed in any one of claims 61 to 66, wherein r_m is in the range of 1.5-2.5 mm.

71. A structural rod as claimed in any one of claims 61 to 66, wherein r_m is about 2.0 mm.

72. A structural rod as claimed in any one of claims 58 to 71, wherein said meso-rods are made from a material selected from the group consisting of ceramic materials including carbon fibres and glass fibres.

73. A structural rod as claimed in claim 72, wherein said polymer matrix is selected from the group consisting of thermoset resins including epoxies, polyesters, and vinyl esters, and thermoplastic resins including nylons, polyethylene, and polypropylene.

74. A reinforcing or structural rod as claimed in any one of claims 38 to 73, having a cross-section that is of a shape selected from the group consisting of circular, elliptical, oval, square,

rectangular, triangular, diamond shapes, dog-bone shaped, L-shaped, T-shaped, U-shaped, and 5-20 sided polygon shaped.

75. A method of inducing toughness in a structural element, comprising embedding in said structural element a plurality of structurally or functionally discrete meso-rods.

76. A reinforcing rod comprising a composite rod having an inner core and an outer surface, said outer surface being textured over a predetermined portion thereof to mechanically grip a concrete matrix in which a said rod is embedded.

77. A rod as claimed in claim 76, wherein said entire outer surface is textured, and portions thereof are masked from contact with a said concrete matrix by the provision of a sheet material thereon.

78. A rod as claimed in claim 77, wherein said sheet material is provided over said entire outer surface, and is selectively removable.

79. A rod as claimed in claim 78, wherein said sheet material is provided with circumferential bands of perforations, to permit portions thereof to be removed without damaging other portions thereof.

80. A rod as claimed in claim 78, wherein said sheet material is provided in longitudinally extending strips separated by longitudinal lines of perforations to permit selected strips to be removed without damaging others.

81. A rod as claimed in claim 79 or 80, wherein said sheet material is provided with indicia thereon to assist in the identification of portions to be removed.

82. A rod as claimed in any one of claims 76 to 81, wherein said outer surface is textured by the provision of a textured outer wrap.

83. A rod as claimed in claim 82, wherein said outer wrap is a polyaramide Kevlar™ outer wrap.